Tackling the Public Health Impact of Climate Change: The Role of Domestic Environmental Health Governance In Developing Countries

WILLIAM ONZIVU*

Abstract

The impacts of climate change are grave challenges to humanity and inequitable to developing countries. Climate change threatens human health through its effects on the stability of ecosystems on which human health depends, and in increased disease pandemics. Multilateral climate change treaties provide the primary mechanisms to foster state and other action to deal with climate change. Global health laws and policies can also spur domestic actions to tackle the health impacts of climate change. Within developing countries, environmental health governance mechanisms demonstrate this potential. Unfortunately, developing countries face wide-ranging challenges in implementing environmental health measures to counteract climate change. The effectiveness of legal, institutional, and other mechanisms in relation to health related actions by developing countries within the context of the global climate change raises a number of legal and practical issues. Therefore, developing countries must continue their legal and institutional reforms to promote health in the context of the climate change legal regime.

I. The Climate Change and Health Challenge

A. THE IMPACTS OF CLIMATE CHANGE: GENERAL

Domestic actions are vital to the implementation of the global climate change regime, but more so in developing countries that face challenges in translating their related legal

* Lecturer in Law, Bradford University Law School, University of Bradford, United Kingdom formerly Legal Officer, World Health Organization, Geneva Switzerland (2000-2007). LLM (with Merit), London School of Economics and Political Science (1998), Makerere University-Kampala (1996). An initial version of this paper was presented at a conference, "Climate Law in Developing Countries: North South Perspectives," organized by the International Union for the Conservation of Nature (IUCN) at the Faculty of Law at the University of Ottawa. The author thanks the Conference participants for their helpful comments. The author would like to thank Diarmid Campbell-Lendrum of the World Health Organization, Geneva for his comments. I also thank Jennifer Amaguru, Rianna Avikoru Onzivu, and Genevieve Aitaasi Onzivu, and Alexandra Fetaru Onzivu for their patience and unwavering support. Comments can be addressed to the author at w.onzivu@bradford.ac.uk.

obligations into concrete actions to tackle climate change. It is in this context that environmental health governance becomes an important mechanism in tackling the health impact of climate change. It is important to establish the linkage between climate change and health. The global climate is facing rapid changes because of a number of factors, notably the burning of fossil fuels and release of green house gases.[1] Global temperatures are also on the rise, and this change is bound to increase in the future. The pattern of global temperature increases over the last century has been attributed to the emission of green house gases resulting from human activities.[2] Moreover, a coherent pattern of change in earth's physical and biological systems has become apparent across all continents: retreat of glaciers, melting of sea ice, polewards extension of insect and plant species, etc.[3] New evidence shows changes in marine and freshwater biological systems associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation.[4] Projected impacts also relate to freshwater resources, ecosystems, food, forest products, coastal systems and low-lying areas, industry, and health. In Africa alone, between 75 and 250 million people are projected to be exposed to increased water stress due to climate change by 2020.[5] Moreover, agricultural production, including access to food in many African countries and regions, is projected to be severely compromised by climatic variations.[6]

B. Health Impacts of Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC), effects of temperature increases have been documented on aspects of human health, such as heat-related mortality, infectious disease vectors, and allergenic pollen in some areas.[7] The IPCC has concluded that projected climate change-related exposures are likely to affect the health status of millions of people, particularly those with low adaptive capacity in developing countries.[8] For example, climate change is expected to have some mixed effects, such as an in the range and transmission potential of malaria in the tropics, especially Africa.[9]

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1. IPCC, *2007: Summary for Policymakers*, *in* Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 2 (Solomon et al. eds., Cambridge Univ. Press 2007).

2. IPCC, Third Assessment Report: Climate Change 2001: Impacts, Vulnerably and Adaptation 3, 77 (Cambridge Univ. Press 2001).

3. *Id.* at 3.

4. *Id.* at 208.

5. M. Boko et al., 2007: Africa Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 435 (M.L. Parry, et al., Eds., Cambridge University Press 2007).

6. *Id.*

7. U. Confalonieri, et al., Human Health Climate Change 2007: Impacts, Adaptation and Vulnerability Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 393 (M.L. Parry et al., eds., Cambridge University Press 2007).

8. *Id.*

9. Willem J.M. Martens et al., *Potential Impact of Global Climate Change on Malaria Risk*, 103 Envtl. Health Persp. 458, 463 (May 1995).

The IPCC has classified the effects of climate change on health as either direct or indirect. Direct effects include heat waves and other extreme events.[10] For example, climate-related disasters have caused thousands of deaths in China, Bangladesh, Venezuela, and Mozambique.[11] Climate change can increase the transportation of airborne pollutants such as fossil fuel pollutants resulting from household and other use.[12] Climate change is also expected to increase the risks of forest fires and associated smoke hazards, as such have occurred in Southeast Asia that led to increases in respiratory and eye symptoms.[13] Indirect effects include limitations relating to food production and supply, causing malnutrition in developing countries.[14] Temperature variability increases the incidence and geographical spread of vector-borne diseases, such as malaria, dengue fever, yellow fever, onchocerciasis, and sleeping sickness.[15] Climate change has also magnified the linkages between human health, water quality and quantity, sanitation, and hygiene. Heavy rainfall transports microbiological agents into drinking water sources, which results in outbreaks of water-borne diseases.[16] For example, cholera epidemics in East Africa and Peru have resulted from widespread environmental and climatic instabilities.[17] Changes in water quality and quantity have resulted in increased incidence of diarrheal diseases, as has occurred in Southeast Asia.[18]

The IPCC has also noted that factors that directly shape the health of populations such as education, health care, public health initiatives, and infrastructure and economic development will be critically important.[19] Establishing the relationship between climate change and health, however, faces challenges.[20] The World Health Organization (WHO) has identified key features of the health effects of climate change.

First, the chain of cause and effect from climate change to changing disease patterns is complex, and includes many non-climatic factors such as environmental and health conditions, access to health care, and behavioral factors.[21] Hence, projected impacts are not only determined by climatic development, but also by changes in these multiple and interacting non-climatic risk factors.[22] These complexities, as well as scant epidemiological data in developing countries, undermine the accuracy of the projected health impacts.[23]

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10. A.K. Githeko & A. Woodward, *International Consensus on the Science of Climate and Health: The IPCC Third Assessment Report*, *in* CLIMATE CHANGE AND HUMAN HEALTH, RISKS AND RESPONSES, 43, 48 (A.J. McMichael et al. eds., World Health Org. 2003).

11. *Id.*, at 48.

12. CLIMATE CHANGE 2001, *supra* note 2.

13. WORLD HEALTH ORG., HEALTH GUIDELINES FOR VEGETATION FIRE EVENTS. (Dietrich H. Schwela et al. eds., World Health Org. 1999).

14. Food and Agricultural Organization, *Climate Change: Implications for Food Security* 30-31, *available at* http://www.fao.org/ag/AGN/agns/files/HLC1_Climate_Change_and_Food_Safety.pdf; *see also* Food and Agricultural Organization, *The State of Food Insecurity in the World: 1999* 8 (1999).

15. Githeko, *supra* note 10, at 49.

16. *Id.* at 49-50.

17. *Id.* at 5.

18. *Id.* at 52.

19. CLIMATE CHANGE 2001, *supra* note 2.

20. Hans-Martin Fussel et al., *Adaptation Assessment for Public Health*, *in* CLIMATE CHANGE AND ADAPTATION STRATEGIES FOR HUMAN HEALTH 41, 48 (Bettina Menne & Kristie L. Ebi eds., Steinkopff Verlag Darmstadt 2006).

21. *Id.*

22. *Id.*

23. *Id.*

Second, climate change exacerbates already existing environmental health conditions.[24] For example, increased production of greenhouse gases not only causes global warming but also traditional industrial and urban pollution.[25]

Third, health impacts of climate change are diverse, globalized, and potentially irreversible.[26] They include increased risks of extreme weather, such as fatal heat waves, floods, and storms, to less dramatic but potentially more serious effects on infectious disease dynamics, shifts to long-term drought conditions in many regions, melting of glaciers that supply freshwater to large population centers, and sea level increases leading to salination of sources of agriculture and drinking water.[27]

Fourth, the health impacts of climate change are potentially huge.[28] Many killer disease conditions in the developing world, such as malaria, diarrhea, and malnutrition, which together cause more than three million deaths each year,[29] are highly sensitive to climatic conditions.[30]

Fifth, the health risks are inequitable because the greenhouse gases that cause climate change originate mainly in developed countries that also possess the resources to tackle the health effects of climate change.[31] Yet the health effects are more pronounced and concentrated in the developing world, which has contributed least to the problem but lacks the resources and infrastructure to tackle the problem.[32] Finally, many of the projected impacts of climate change on health can be prevented through mitigation by public health interventions as well as adaptation measures in health-related sectors such as agriculture and water management, and a long-term strategy to reduce adverse human impacts on climate.[33]

II. Climate Change and Health: The International Legal and Policy Frameworks

A. Health in International Climate Law and Policy

1. *Health and Climate Change Discourse*

The human health consequences of climate change are occurring now.[34] The health consequences are predicted to be the worst for the poorest in developing countries.[35] The world's poorest nations already suffer from the kinds of food and water shortages that will

24. *Id.*
25. *Id.*
26. Diarmid Campbell-Lendrum, et al., *Global Climate Change: Implications for International Public Health Policy*, Bull. of the World Health Org., Mar. 2007, at 235.
27. *Id.*
28. *Id.*
29. World Health Org., The World Health Report 2004: Changing History (WHO 2004).
30. Campbell-Lendrum, *supra* note 26, at 235.
31. *Id.*
32. Jonathan A. Patz et al., *Impact of Regional Climate Change on Human Health*, 438 Nature 310, 315 (Nov. 17, 2005).
33. Campbell-Lendrum, *supra* note 26, at 235.
34. Patz, *supra* note 32, at 310.
35. Jonathan A. Patz & R. Sari Kovats, *Hotspots in Climate Change and Human Health*, 325 Brit. Med. J. 1094, 1094 (Nov. 9, 2002).

only worsen in the coming years; their capacity to handle further scarcity is limited.[36] They also lack the resources (such as funds for relocation necessitated by rising sea levels) and services (such as health care) that will be necessary in any effort to mitigate the effects of climate change.[37] The poorer countries are also those that have contributed the least to the present problem but are also less equipped to deal with the results and more vulnerable to disruptions of their ability to meet the basic needs of their people.[38] The health and climate change discourse also ensures a convergence of anthropocentric and eco-centric approaches to environmental protection where the health and well-being of mankind depends upon the health of the environment and avoids having to decide whether to advance "us" or the "new us."[39]

Therefore, framing public debate and public policy on climate change in terms of health has significant implications which comprise stimulating political action in the global north or south to tackle climate change, and enlarging the number and kinds of governmental or non-governmental actors involved in tackling climate change. Both international climate change, as well as health, laws, and policies provide for mechanisms to tackle the public health impact of climate change at the domestic level.

2. *The United Nations Framework Convention on Climate Change*

The United Nations Framework Convention on Climate Change has been hailed as an international legal instrument with great potential to advance global public health.[40]

International climate change law consists of two climate change conventions: the United Nations Framework Convention on Climate Change (UNFCCC),[41] and its Kyoto Protocol.[42] The UNFCCC does not make many explicit references to public health, but does contain some relevant provisions. First, the UNFCCC defines "adverse effects of climate change" as "changes in the physical environment or biota resulting from climate changes which have significant deleterious effects on ecosystems or on the operation of socio-economic systems or on human health and welfare."[43] Second, parties to the UNFCCC are required to employ appropriate methods, such as impact assessments, with a view toward minimizing adverse effects on the economy, public health, and the quality of the environment, for projects or measures undertaken by them to mitigate or adapt to climate change.[44]

Third, parties are also required to "promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of

36. SIR NICHOLAS STERN, GR. BRIT. OFFICE OF CLIMATE CHANGE, STERN REVIEW: THE ECONOMICS OF CLIMATE CHANGE 103 (2006), *available at* http://www.hm-treasury.gov.uk/stern_review_report.htm.

37. *Id.* at 92.

38. MARIE-CLAIRE CORDONIER SEGGER & ASHFAQ KHALFAN, SUSTAINABLE DEVELOPMENT LAW: PRINCIPLES, PRACTICES & PROSPECTS 360 (Oxford Univ. Press 2004).

39. PRUE TAYLOR, AN ECOLOGICAL APPROACH TO INTERNATIONAL LAW: RESPONDING TO CHALLENGES OF CLIMATE CHANGE 236-37 (Routledge 1998).

40. Yasmin Von Schirnding et al., *International Environmental Law and Global Public Health*, 80 BULL. OF THE WORLD HEALTH ORG., 970, 970-74 (2002).

41. United Nations Framework Convention on Climate Change, May 9, 1992, 31 I.L.M. 849, *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf [hereinafter FCCC].

42. *Id.*

43. FCCC, *supra* note 41, art. 1, ¶ (1).

44. *Id.* art. 4, ¶ (1)(f).

data archives related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of climate change and the economic and social consequences of various response strategies."[45]

Fourth, in carrying out their commitments under Article 4, paragraph 1(g), parties are required to support and develop programs and networks or organizations aimed at strengthening systematic observation and national scientific and technical research capacities in developing countries.[46]

In this connection, Decision 5/CP.7 of the UNFCCC's Conference of Parties (COP) recognizes that the problems of poverty, land degradation, access to water and food, and human health remain at the center of global attention and adopted a framework for implementation of health activities with support from the Special Climate Change Fund and other mechanisms.[47]

B. Climate Change in Global Health Law and Policy

1. *Global Health in the Era of Climate Change*

Climate change is a defining challenge to the protection of public health because health protection demands require a full appreciation of climate impacts, and climate change mitigation reflects contemporary public health improvement efforts, such as reduced pollution.[48]

Major global health policy has been spearheaded by the WHO, whose constitution empowers the organization to promote global health in ways that include the spearheading of development of international law and policies.[49] The WHO has called upon its Member States to tackle the health impacts of climate change.[50] Public health experts have stressed that the global public health community has a common interest in addressing climate change-related health risks wherever they occur in the world.[51] In developing countries, there is a realization that climate change is not simply an environmental or developmental concern but also a health issue, which has in turn contributed to the adoption of a WHO resolution on health and climate change.[52]

C. The WHO Resolutions on Climate Change

On May 24, 2008, WHO's World Health Assembly passed a resolution on health and climate change.[53] The 193 countries represented at the 2008 World Health Assembly

45. *Id.* art. 4, ¶ (1)(g).

46. *Id.* art. 5, ¶ (a)-(b).

47. FCCC, Conference of the Parties on its Seventh Session, Marrakesh, Morocco, Oct. 29 – Nov. 10, 2001, Decision 5/CP.7, 32-36, U.N. Doc. FCCC/CP/2001/13/Add.1 (Jan. 21, 2002).

48. *See generally*, The Climate Connection, www.theclimateconnection.org.uk.

49. World Health Org., WHO Const., art. 18-19, *available at* http://www.who.int/governing_who_constitution_en.pdf.

50. W.H.O. Res. WHA61.19, § 2 ¶ 1- 5 (May 24, 2008).

51. Maria Neira et al., *The Year 2008, A Breakthrough Year for Health Protection from Climate Change?*, 35 Am. J. Prev. Med. 424, 424 (2008).

52. W.H.O. Res. WHA61.19, *supra* note 50, at ¶ 5.

53. *Id.*

gave unanimous and outspoken support for the new resolution, calling for greater engagement on the issue of climate change and health. This resolution requests WHO to further strengthen its existing program of support to countries, and to ensure that health concerns are fully discussed in the international climate change debate.[54] The resolution endorsed the findings of the IPCC, which found that temperature increases affect human health and that the net global effect of projected climate change on human health is expected to negatively affect developing countries' capacity to adapt to such change.[55] The resolution recognized "that solutions to the health impacts of climate change should be seen as a joint responsibility of all States and that developed countries should assist developing countries in this regard."[56] It also recognized "the need to assist Member States in assessing the implications of climate change for health and health systems in their countries, in identifying appropriate and comprehensive strategies and measures for addressing these implications, [and] in building capacity in the health sector to do so . . . ."[57] Finally, it recognized that "strengthening health systems to enable them to deal with both gradual changes and sudden shocks is a fundamental priority in addressing the direct and indirect effects of climate change for health . . . ."[58]

The resolution requests the WHO Director-General to provide leadership on health and climate change through a number of actions, including promoting health in climate change adaptation measures and encouraging such assistance to developing countries.[59] The resolution calls upon Member States to undertake a number of measures to tackle the health impact of climate change.[60] For example, they are asked to "develop health measures and integrate them into plans for adaptation to climate change as appropriate to strengthen the capacity of health systems for monitoring and minimizing the public health impacts of climate change through adequate preventive measures; [and] to promote effective engagement of the health sector and its collaboration with all related sectors" at national and global levels.[61]

A number of WHO Regions have also adopted similar resolutions. For example, Member States of the WHO African Region adopted a Framework of Action to increase awareness, and place public health concerns and health protection from climate variability and climate change at the center of regional, national, and international action on climate change.[62] The plan also urges the WHO and Member States to strengthen health systems' capacities to provide protection from climate-related health risks by implementing informed adaptive strategies at local and national levels that minimize the impact of climate variability and change on population health, and to integrate these strategies into national climate change adaptation plans and programs.[63]

54. *See id.*

55. *Id.* at 1.

56. *Id.*

57. *Id.*

58. *Id.* at 2.

59. *Id.* at 2-3.

60. *See id.* at 3.

61. *Id.* at 3.

62. WHO Regional Office for Africa, *The Work of WHO in the African Region 2008: Annual Report of the Regional Director*, Reg'l Comm. Res. AFR/RC59/2, at 26, (2009).

63. *Id.*

The Action Plan encourages Member States to ensure that health concerns are included in development strategies in other sectors to adequately support decision-making, to protect and promote public health now and in the future, and to strengthen the institutional capacity of the health community to provide guidance and leadership on health protection from climate change.[64]

WHO resolutions are soft law, meaning that Member States are required to implement them into the corpus of their domestic legal and policy frameworks, and most Member States do implement the resolutions. Implementation and enforcement of these resolutions occurs through the annual reports of each Member State to the World Health Assembly.[65]

III. Domestic Actions to Tackle Climate Change and Health in Developing Countries: Legal Basis and Emerging Policy Convergence

A. Climate Change Law and Policy

The implementation of climate change legal regime focuses on mitigation and adaptation.[66] Mitigation requires each party to reduce greenhouse gas emissions in order to reduce and halt climate change. Parties are also required to undertake actions focusing on adaptation to climate change, including common and differentiated responsibilities between developed and developing nations. It requires comprehensive institutional and policy initiatives at the domestic level to counteract climate change. On matters of domestic implementation of the climate change regime and its relevance to health, there are applicable provisions in the UNFCCC. The objective of the climate change treaties is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.[67] "Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."[68]

All parties are required to develop national inventories of anthropogenic emissions of all greenhouse gases, and to implement measures to both mitigate climate change and facilitate adequate adaptation to climate change in all relevant sectors.[69] Parties are required to promote and cooperate in the development, application and transfer of technologies to control, reduce, or prevent anthropogenic emissions of greenhouse gases, as well as to promote sustainable management and promote and cooperate in their conservation and enhancement.[70] They are also required to "cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate integrated plans for coastal zone man-

64. *Id.*
65. WHO Const., *supra* note 49, at art. 20.
66. FCCC, *supra* note 41, art. 4(2) and (4).
67. *Id.* art. 2.
68. *Id.* art. 2
69. *Id.* art. 4(1)(a), (b), and (c).
70. *Id.* art. 4(1)(c) and (d).

agement, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods."[71]

Parties are also required to "take climate change considerations into account, to the extent feasible, in their relevant social, economic, and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change."[72] In addition, parties are required to "promote and cooperate in the full, open and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate system and climate change, and to the economic and social consequences of various response strategies."[73] They are further required to "promote and cooperate in education, training, and public awareness related to climate change and encourage the widest participation in this process, including that of non- governmental organizations."[74] It is in this connection that Bloomberg and Aggarwala have concluded that carbon-reduction efforts, an important tool of mitigation in the climate change legal regime, can have a significant positive impact on public health.[75] As they have noted, health is not a minor fringe benefit of carbon reduction because "[t]he illnesses we can prevent through transportation and other policy changes that reduce combustion emissions—obesity related, respiratory, and cardiovascular problems are among the most prevalent and expensive diseases in many developed countries."[76] Unfortunately, the implementation and follow-up of international environmental agreements in developing countries is impeded by lack of funds, expertise, manpower, and appropriate scientific information.[77] It is in this regard that environmental governance is an important mechanism in implementing the health related measures on climate change in developing countries.

B. Environmental Health Law and Policy Perspectives

Environmental health governance reflects techniques for general environmental management. First, these techniques include environmental quality standards that seek to set a certain environmental threshold in relation to air, water, soil or population standards.[78] Second, it also includes emission standards identifying the amounts a facility may emit.[79] Third, it includes product standards specifying characteristics deemed necessary to avoid environmental harm from the use of certain products, and these standards are used to protect human health.[80] Fourth, process standards specifying how products are to be pro-

71. *Id.* art. 4(1)(e).
72. *Id.* art. 4(1)(f).
73. *Id.* art. 4(1)(g).
74. *Id.* art. 4(1)(i).
75. Michael R. Bloomberg & Rohit T. Aggarwala, *Think Locally, Act Globally: How Curbing Global Warming Emissions Can Improve Local Public Health*, 35 Am. J. Prev. Med. 414, (2008).
76. *Id.*
77. *See* Chowdury R. Abrar , Improving Compliance with International Environmental Law 218 (James Cameron et al., eds., Earthscan 1995).
78. Marie-Claire Cordonier, *supra* note 38, at 360.
79. *Id.*
80. *Id.*

duced, and what impact they may have on the environment are included.[81] Finally, performance standards, such as Environmental Impact Assessments ("EIAs"), play an important role in environmental management.[82] Health experts have concluded that the options to tackle the health impacts of climate change are essentially a matter of basic public health protection.[83] Environmental health measures based on public health strategies provide the tools for mitigation as well as adaptation, as required under global climate change conventions.[84] Preventative public health interventions on issues such as malaria control, protection of freshwater, and prevention of water pollution provide important strategies to tackle health impacts of climate change. Enhancing water law and quality is an example of how an environmental health law could contribute to fighting climate change.

Experts have also stated that epidemiological surveillance that integrates surveillance of human, climatic, and environmental conditions can help in tackling infectious disease and vectors such as the spread of malaria that are associated with climate change. The health sector must also be keen to promote policies that reduce deforestation, conserve the integrity of watersheds and coastal zones, minimize the physical impacts of mudslides and storm surges, and decrease the chances of sewage contamination in order to tackle the health effects of flooding such as water borne diseases.[85]

The public health threats of climate change, as well as the legal and policy instruments, require the strengthening of domestic governance infrastructures to tackle the threat. This need for strengthening derives from the fact that developing countries possess weak legal, policy, and institutional capabilities to address the health implications of climate change.

IV. Domestic Actions to Tackle the Health Impacts of Climate Change in Developing Countries: The Environmental Health Governance Mechanisms

A. Environmental Health Governance in Developing Countries: The Trends

Despite efforts at integration, domestic environmental health regimes in developing countries continue to be implemented predominantly through sectoral legal and institutional mechanisms.[86] The minimal horizontal legislative and institutional infrastructure and their integration undermine the implementation of global environmental agreements that have the potential to promote health in developing countries.[87] The complexities of tackling the health impact of climate change require knowledge of the state of environmental health governance in developing countries.

81. *Id.*
82. *Id.*
83. Campbell-Lendrum, *supra* note 26, at 235.
84. *Id.*
85. *Id.* at 236.
86. William Onzivu, *International Environmental Law, the Public's Health, and Domestic Environmental Governance in Developing Countries*, 21 Am. U. Int'l L. Rev. 597, 637 (2006).
87. *Id.*

First, environmental health is promoted and protected by legislation. Many developing countries have adopted laws to address areas of environmental health such as water, sanitation, and pollution among others. Many of these issues are also addressed in comprehensive or piecemeal sectoral health laws. Furthermore, framework environmental laws comprise the body of environmental law that serves to protect health. Second, environmental health is institutionally coordinated by ministries of health, as well as environmental agencies. Environmental health is also substantially devolved to provinces, districts, and local health authorities.

These public health strategies should be viewed against the backdrop of environmental health as well as climate change regimes in developing countries. From both the global climate change law and public health perspective, key governance mechanisms for tackling the health impact of climate change include the role of domestic environmental health legislation, the importance of national plans of action, the role of the health sector, the importance of inter-agency multi-sectoral coordination mechanisms, the role of impact assessments, mechanisms for capacity building, financial and technological transfer, and participation of nongovernmental organizations.

B. Environmental and Health Legislation

Both the UNFCCC and Kyoto Protocol require parties to adopt or strengthen adaptation and mitigation measures to tackle climate change. A number of developed countries have adopted specific climate change legislation, but these laws have focused on emissions trading and renewable energy.[88] There is a dearth of climate change legislation in developing countries.

For example, Maldives, like many developing countries, lacks appropriate climate change policy, legislation, planning, and management.[89]

This lack may be partly because in many countries, existing environmental and sectoral health legislation frameworks offer a potential mechanism to deal with health impacts of climate change. Several issues for legislative action to tackle the health impact of climate change have been identified. These issues include substantive and procedural legislative frameworks for tackling the impact of heat waves as well as floods on human health, and the role of legal strategies to tackle vector- and rodent-borne diseases. Environmental health legislation comprises environmental laws and health laws that promote environmental health. Environmental health legislation in many developing countries is fragmented and sectoral. Sectoral environmental laws include public health acts, water laws, and laws in agricultural, forestry and other areas. Recent decades in developing countries have been marked by more comprehensive efforts to create legislative frameworks for environmental management.[90] These laws often promote and protect the environment, as well as provide a framework for environmental health protection.

88. *See* Climate Change and Sustainable Energy Act, 2006, c. 19, (Eng.); New Zealand Climate Change Response Act, 2002, 2002 S.N.Z. No. 40 (N.Z.); Climate Change Bill 187-2, 2007 (N.Z.).

89. Republic of Maldives, Ministry of Environment, Energy and Water, National Adaptation Programme of Action (2007), *available at* http://unfccc.int/resource/docs/napa/mdv01.pdf.

90. Benjamin J Richardson, et al., *Environmental Law in Post-Colonial Societies: Aspirations, Achievements and Limitations*, *in* Environmental Law for Sustainability, 413, 418 (Benjamin J Richardson & Stephan Wood eds., Hart Publishing 2006).

Indeed, legal reform of framework environmental laws and sectoral laws could help address climate related health concerns such as malaria control, the improvement of water quality, the enhanced response of health systems' infrastructure to flood- or heat-related public health disasters, and the promotion of scientific and technological capacities to tackle the health challenges of climate change. For example, to tackle the health impacts of climate change, Zambia needed to take measures to improve human health by reducing the widespread vulnerabilities to droughts and floods.[91] But its existing environmental health policies, laws, and measures have not integrated climate risk management, and they lack adequate institutional mechanisms for effective community-based implementation of legislation.[92] Vanuatu identified the lack of enforcement of existing legislation or absence of sound environmental management systems, as well as the absence of specific climate change legislation, as challenges in dealing with impact of climate change.[93]

The challenge for developing countries is to mainstream climate risk management into environmental health law, policy, and practice at the community level on issues such as climate-proof sanitation, drainage, and water supply facilities. In developing countries, environmental health focuses on specific health threats such as sanitation, pollution, and other occupational diseases. In many developing countries, not all health threats related to environmental change have been addressed in the corpus of environmental health laws.[94] Moreover, inadequate public awareness of climate change hinders public participation in helping to shape climate change policy and legislation.[95]

Unfortunately, there are a number of limitations of domestic environmental health legal regimes to address the health impacts of climate change. First, efforts by developing countries to reform environmental health laws in the health sector have been slow-coming. Most environmental health laws address minimal issues such as basic water and sanitation issues, food, hygiene, etc. These laws have failed to keep pace with the scale of modern environmental threats such as climate change. Moreover, the legal frameworks for addressing sectoral responses to climate change are often specialized, and have not been integrated into mainstream environmental legislation. For example, lack of a clear and specific legal and policy framework for climate change issues in Zambia was identified as a challenge.[96] No legal framework had been developed to ensure that climate change issues at various levels were properly institutionalized in the planning and policy process. This lack of framework stemmed from the fact that most adaptation interventions to reduce the risks of climate variability would require "fine-tuning" of existing policies and programs to make them relevant and robust.

Second, environmental health laws in many developing countries are archaic and do not address issues that *indirectly* affect health. For example, most public health laws do not

91. REPUBLIC OF ZAMBIA, MINISTRY OF TOURISM, ENVIRONMENT, AND NATURAL RESOURCES, FORMULATION OF THE NATIONAL ADAPTATION PROGRAMME OF ACTION ON CLIMATE CHANGE 17 (2007), *available at* http://unfccc.int/resource/docs/napa/zmb01.pdf.

92. *Id.*

93. NATIONAL ADVISORY COMMITTEE ON CLIMATE CHANGE, REPUBLIC OF VANUATU, NATIONAL ADAPTATION PROGRAMME OF ACTION, 2007 17, 19-20 (2007), *available at* http://unfccc.int/resource/docs/napa/vut01.pdf.

94. *See* World Health Org., Office for Africa—Country Profiles for Environmental Health Policy, http://www.afro.who.int/des/phe/country_profiles/index.html.

95. *Id.*

96. *Id.*

address health issues during flood or heat emergencies. Rather, such enabling laws may be found in disaster management ministries, and yet inter-ministerial coordination on sectoral issues may pose challenges.[97] It has been discovered that specific enabling legislation including memoranda between the health ministry and other sectors on such issue is required. The lack of legal frameworks for health action in such disasters undermines efforts to tackle the health impacts of climate change.

Third, sectoral law mandates, as well as institutional frameworks for environmental health, are less effective due to sectoral conflicts. In many developing countries, domestic implementation of environmental conventions could be potentially undermined by conflicting sectoral mandates and procedures, as well as by the lack of cooperation between the different agencies.[98] Chowdury has identified the absence of coordination between governmental agencies and ineffective legal instruments as impediments to implementation of environmental commitments in Bangladesh.[99] Legal strategies that address climate change mitigation and adaptation require the involvement of several agencies beyond health, but the integration of health laws into other sectoral laws has always been a challenge. Therefore, the review, adoption, and strengthening of environmental health laws is an essential first step in tackling the health impacts of climate change.

C. Institutional Coordination Mechanisms

The IPCC has stated that developing countries and those with economies in transition have a lower capacity to adapt, and inadequate institutional mechanisms are cited as key hindrances to adaptation to climate change.[100] The UNFCCC requires effective institutional cooperation to tackle climate change. For example, Article 4(c) requires parties to promote and cooperate in the development, application, diffusion, and transfer of technologies, practices, and processes to control, reduce, or prevent anthropogenic emissions of greenhouse gases in all relevant sectors, including the energy, transportation, industrial, agricultural, forestry, and waste management sectors. The implication of this provision is that multi-sectoral action is essential to tackle the health impacts of climate change, and to meet the resulting costs. In developing countries that have established institutional coordinating mechanisms, such as Brazil, Chile, Egypt, India, Nigeria, Pakistan, Uganda, and Zambia, environmental decision-making tends to be concentrated among centralized governmental authorities that rely heavily on command and control regulation.[101] In some developing countries such as Ethiopia, Madagascar, and Kenya, "Climate and Health Steering Committees" have been established.[102]

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97. William L. Andreen, *Environmental Law and International Assistance: The Challenge of Strengthening Environmental Law in the Developing World*, 25 Colum. J. Envtl. L. 17 (2000).

98. Ibrahim F.I Shihata, *Implementation, Enforcement, and Compliance with International Environmental Agreements-Practical Suggestions in Light of the World Bank's experience*, 9 Geo. Int'l Envt'l. L. Rev. 37, 50 (1996).

99. *See* Chowdury R. Abrar, *International Agreements and Environmental Management Follow-up in Bangladesh*, *in* Improving Compliance with International Environmental Law 218 (Earthscan Publications Ltd., London 218 1996).

100. Climate Change 2001, *supra* note 2.

101. Richardson, *supra* note 90, at 418.

102. *See* Neil Bird & Njeru Kirira, Government Institutions, Public Expenditure and the Role of Development Partners: Meeting Kenya's Environmental Challenges 5 (Overseas Development Institute 2009), *see* Nat'l Meteorological Agency, Ministry of Water Res., Climate Change Technology Needs Assessment Report of Ethiopia, 1 (Abebe Tagege ed., 2007), *available at*

Yet, the health impacts of climate change involve, both directly and indirectly, multiple sectors at varied institutional levels, both national and sub-national. In developing countries, while the health sector is often the lead sector in matters of environmental health, climate change coordination is often delegated to the environmental, energy and industrial agencies, or to those that regulated transportation or the meteorological service, or to an independent national task force. The health sector is often only marginally involved in policy-setting and measures relating to implementation of the climate change regime. Many developing countries have established multi-sectoral coordination bodies that draw upon varied sectoral expertise and experiences in tackling health and environmental issues. For example, in 1989, Vanuatu established a multi-disciplinary National Advisory Committee on Climate Change (NACCC), drawn "from government agencies, civil society, and other relevant stakeholders."[103] Its role included "encouraging appropriate policy development to enable effective national responses to climate change," "coordinating international negotiations, ensuring consistency, relevancy and real benefits to Vanuatu," integrating climate change issues into sectoral policies, and other departmental plans.[104] In Mozambique, a national coordinating institution draws experts from agriculture, energy, health and environmental management, disaster management, and meteorology.[105] In Maldives, the coordination committee is multisectoral, and the Ministry of Health is the lead agency for coordinating health projects with other project partners, which include environmental, energy, water, and Atolls Development Ministries, Male Municipality, Atoll Offices and island offices, and NGO and community organizations.[106] A challenge identified is the lack of ownership of sectoral climate change-related projects by other departmental agencies that may not be the lead agency for a particular sectoral area.

Developing countries face challenges, which include the weak or minimal expertise, differential sectoral policies, and budgets that may undermine multi-sectoral measures whose use may face obstacles within each sector.

Environmental health actors extend beyond health, and yet there are fractious and often ineffective collaboration mechanisms among these agencies.[107] The result is that environmental health sits in an institutional limbo with limited efforts by other sectors to integrate it into their activities. This situation, however, is not the reality in developing countries where governmental sectors jealously protect their sectoral interests, mandates and funding, and are reluctant to implement cross-sectoral measures without corresponding resources from other sectors. Why should transport and industrial sectors clear drains to reduce mosquito breeding sites for malaria control, and why would they use their sectoral resources to do that as well as coordinate with other sectors? Therefore, environmental health efforts are hampered by a lack of incentive or motivation in agencies with other priorities.

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http://unfccc.int/ttclear/pdf/TNA/Ethiopia/Ethiopian%20Official%20TNA%20Document.pdf; NATIONAL ADVISORY COMMITTEE ON CLIMATE CHANGE, *supra* note 93, at 19.

103. Richardson, *supra* note 90, at 413.

104. NATIONAL ADVISORY COMMITTEE ON CLIMATE CHANGE, *supra* note 93, at 19-20.

105. MINISTRY FOR THE CO-ORDINATION OF ENVIRONMENTAL AFFAIRS, MOZAMBIQUE, NATIONAL ADAPTATION PROGRAMME OF ACTION 2 (July 2008), *available at* http://unfccc.int/resource/docs/napa/moz01.pdf.

106. MINISTRY OF ENVIRONMENT, ENERGY, AND WATER, *supra* note 89, at 65.

107. Andreen, *supra* note 97.

In Uganda, in one of the projects on Vectors, Pests and Disease Control related to climate change, the Ministry of Water, Lands and Environment (Department of Meteorology) is the official recipient of project resources, and will delegate to appropriate institutions to implement the project.[108] The health sector is not explicitly mentioned.[109] Indeed, the Uganda National Adaptation Programme of Action (NAPA) identifies weak institutional and coordinating mechanisms as one of the challenges to the implementation of climate change legal regime in Uganda.[110]

Recent legal and institutional developments in Nigeria offer an example. In 2007, Nigeria adopted the National Environmental Standards and Regulations Enforcement Agency Act (the Act).[111] The Act establishes a National Environmental Standards and Regulations Enforcement Agency, and defines its functions and powers.[112] The Act is a trendsetter because it provides a domestic legal framework for promoting compliance with the UNFCCC and the Kyoto Protocol, as well as international instruments that address pollution, sanitation, and other agreements as they come into force. The Act also provides for a mechanism to enforce compliance with policies, standards, legislation, and guidelines on, inter alia, water quality, environmental health, and sanitation, including pollution management.

Despite this noble legal framework, the institutional framework for the implementation of the Act has shortcomings in relation to environmental health protection. A Governing Council includes the environment, minerals, agriculture, water, science and technology, energy, oil companies, and civil society. Conspicuously, the health sector is excluded from this important implementation board. This institutional incoherence has the potential to undermine efforts to address not only the health implications of climate change, but also efforts to promote environmental health generally.

Similarly, Samoa's National Program of Action includes a climate health cooperation project.[113] Implementation of the plan is the responsibility of the ministries of Health, Natural Resources, and Environment Meteorology.[114] The project aims to strengthen the policy and institutional frameworks to prioritize health and climate change cooperation at the domestic level. The challenge in Samoa is that health is just one of nine priority projects.[115] Other challenges identified include insufficient local epidemiological information and the high costs involved.[116]

Collaboration with another agency can sometimes compensate for unintentional neglect based on administrative efficiency. But such coordination has been weak, primarily due to

108. *See* GOVERNMENT OF UGANDA, CLIMATE CHANGE, UGANDA NATIONAL ADAPTATION PROGRAMMES OF ACTION 63 (2007), *available at* http://unfccc.int/resource/docs/napa/uga01.pdf.

109. *Id.*

110. *Id.* at 50.

111. The National Environmental Standards and Regulations Enforcement Agency Act (Act), (2007) 25:31 O.G., 95 (Nigeria). Further information on National Environmental Standards and Regulations Enforcement Agency (Establishment) Act can be accessed at http://www.nesrea.org/about_NESREA.php.

112. *Id.* § 1, A637-41.

113. MINISTRY OF NATURAL RESOURCES, ENVIRONMENT & METEOROLOGY, SAMOA, NATIONAL ADAPTATION PROGRAMME OF ACTION 32-35 (Dec. 2005), *available at* http://unfccc.int/resource/docs/napa/sam01.pdf.

114. *Id.* at 34.

115. *Id.* 33-34.

116. *Id.* at 23-24.

a lack of understanding of environmental health linkages, poor inter-agency communication, and resource constraints. Other factors for this institutional gap include lack of appreciation of the broad impact of climate change, lack of procedures of multi-sectoral collaboration, budgetary limitations, sectoral biases, as well as insufficient involvement of the health sector in projects to mitigate or adapt to climate change, because such projects may be led by technology, transportation, and other sectors.[117] Environmental health issues related to climate change are marginal for the business, commerce, industry, and government agencies that create and contribute directly or indirectly to climate change and its health effects. Lack of formal input from the health sector could be addressed through environmental assessments, but this mechanism has not always been effective to promote environmental health. Moreover, at the international level, the participation of the health sector in climate change negotiations has been minimal.[118]

Therefore, the health sector must re-orient itself to tackle climate change through multi-sectoral actions in concert with other sectors or ministries. This need for action derives from the fact that tackling the health impact of climate change transcends the mandates of health ministries to other sectors such as the environment, transport, industry and energy, agriculture, rural affairs, and others.

D. National Action Plans

In response to the requirements of the climate change conventions, most developing countries have implemented a National Adaptation Program of Action ("NAPA"). These plans have been developed with support from the Global Environment Facility under the UNFCCC and, in many cases, without a broad domestic climate change policy. These adaptation plans often identify health alongside agriculture and water as the most vulnerable sectors to climate variability and change.[119] Ethiopia, for example, has adopted a number of strategies on health.[120] These include implementing programs that help to prevent and control communicable diseases like malaria through community participation, and help to organize and implement community-based health education programs to create awareness and develop knowledge about personal hygiene and environmental health management.[121] The plans also seek to develop and introduce surveillance systems, methods of health prevention and vector control for health workers and the community, and provide training programs to build the manpower capacity to improve the provision of health extension services at the local level.[122] Vanuatu has also adopted a National Disaster Plan, and the Ministry of Health has led in developing a sectoral plan to put the national plan

117. Fussel *supra* note 21, at 48.

118. For example, at the Bali Conference of Parties, only Belgium, Canada, Thailand and Jamaica had health delegates. Framework Convention on Climate Change, Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG), Bangkok, March 31-April 4, 2008, Bonn, June 2–12, 2008; Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWGLCA), Bangkok, March 31-April 4, 2008, *List of participants*, 4, 5, 10, U.N. Doc. FCCC/SB/2008/INF.2 (April 2, 2008).

119. *See* Ministry of Water Resources, National Meteorological Agency, Federal Democratic Republic of Ethiopia, National Adaptation Programme of Action of Ethiopia 5 (June 2008), *available at* http://unfccc.int/resource/docs/napa/eri01.pdf.

120. *Id.* at 34.

121. *Id.* at 35.

122. *Id.* at 34.

into operation.[123] The sectoral plan identifies the major risks that any health facility throughout Vanuatu could be faced with, such as earthquakes, droughts, and tropical cyclones, and identifies climate change and sea level rise as factors for establishing any health facility.[124] In Mozambique, the impact of climate change on human health was included as a criterion for priority planning action.[125]

The National Development Plan of Maldives includes access to safe drinking water, the provision of sanitation, and the promotion of hygiene and public health as not just sectoral but rather broad national priorities.[126] Bangladesh's National program of action on climate change draws upon contributions of six sectoral groups.[127] These groups include Agriculture, Fisheries, and Livestock coordinated by Bangladesh Agricultural Research Council; Forestry, Biodiversity and Land-use coordinated by International Union of Conservation of Nature (IUCN); Water, Coastal Zone, Natural Disaster and Health, coordinated by Water Resources Planning organization; Livelihood, Gender, Local Governance and Food Security, coordinated by Bangladesh Institute for Development Studies; and industry and infrastructure coordinated by the Department of Environment and Policies and Institutes coordinated by the Bangladesh Centre for Advanced Studies.[128] The plan recognizes that in Bangladesh, temperature rise, drought, sea level rise, salinity intrusion, and floods have greatly impacted public health.[129] It is in this connection that the public health engineering department is implementing a priority project to provide drinking water to coastal communities to combat enhanced salinity due to sea level rise.[130] In Sao Tome and Principe, health has been identified as one of the priorities for action. The elaboration of a sectoral strategic and emergency plan emphasizes that the role of the health sector is being developed.[131]

The challenge for these and other developing countries has been to streamline these policies with other action plans such as national environmental action plans, national health action plans, and national environmental health action plans that provide for the mechanisms to implement health related actions of the climate change programs.[132] Bureaucratic governance structures of line ministries, resource constraints, as well as the predominance of curative health structures over preventative programs can greatly undermine the effectiveness of adaptation plans to counteract the health impact of climate change. With the plethora of environmental health issues, the challenge for developing countries is to streamline and integrate climate change adaptation programs of action into sectoral health and environmental plans.

123. NATIONAL ADVISORY COMMITTEE ON CLIMATE CHANGE, *supra* note 93, at 22.

124. *Id.*

125. MINISTRY FOR THE CO-ORDINATION OF ENVIRONMENTAL AFFAIRS, *supra* note 105, at 14.

126. MINISTRY OF ENVIRONMENT, ENERGY, AND WATER, *supra* note 89, at 57.

127. MINISTRY OF ENVIRONMENT AND FOREST, PEOPLE'S REPUBLIC OF BANGLADESH, NATIONAL ADAPTATION PROGRAMME OF ACTION (Nov. 2005), *available at* http://unfccc.int/resource/docs/napa/ban01.pdf.

128. *Id.*

129. *Id.* at 18.

130. *Id.* at 27-28.

131. MINISTERIO DOS RECURSOS NATURAIS E AMBIENTE, REPUBLICA DEMOCRATICA DE S. TOME E PRINCIPE, NATIONAL ADAPTATION PROGRAMME OF ACTION ON CLIMATE CHANGE 20, 24, 29, 30 (Nov. 2007), *available at* http://unfccc.int/resource/docs/napa/stp01.pdf.

132. *See* Onzivu, *supra* note 86, at 642.

Several activities directed toward the accomplishment of Millennium Development Goals ("MDGs"), as well as other development initiatives, are in peril because of climate change. For instance, efforts to reduce the incidence of malaria might be hampered by an increased risk of epidemics due to an expansion in the range of malaria-prone areas. In order to secure the development gains in fields such as public health, infrastructure building, and poverty reduction, many of these activities need to incorporate climate change risk considerations, so as to "climate-proof" them. Also, improved environmental management is needed as a preventative measure to reduce the breeding grounds in which vectors thrive. This plan takes more of a preventative approach than a post-contraction response.

E. Environmental (and Health) Impact Assessments

The Conference of the Parties in Bali resolved to enhance action on adaptation through international cooperation to support urgent implementation of adaptation actions, such as vulnerability assessments, prioritization of actions, financial needs assessments, capacity-building and response strategies, integration of adaptation actions into sectoral and national planning, specific projects and programs, means to incentivize the implementation of adaptation actions, and other ways to enable climate-resilient development and reduce vulnerability of all Parties, especially developing countries including Africa.[133]

One important tool to implement these measures is through impact assessments, especially environmental and health impact assessment as well as strategic and climate impact assessment. Moreover, the international climate change regime, as well as the IPCC, emphasizes the role of science in dealing with the risks and uncertainties of climate change.[134]

The major issue is the extent to which health impacts are considered in these assessments. But these mechanisms have limitations in developing countries. For example, Zambia's environmental impact assessment regime was found to be "weak and lacking best standards and practices that consider climate change implications."[135] Cape Verde would like to prioritize health within its domestic climate change program, but has been hampered by the challenges of conducting vulnerability and other assessments.[136]

There are other challenges regarding the role of impact assessments in counteracting the health impacts of climate change. First, EIAs require an upfront prediction of the likely environmental consequences and a single regulatory approval.[137] Yet adaptation contemplates an initial regulatory approval based on initially available information (perhaps guess-work, estimation or "regulatory science"), followed by a period of monitoring and reporting, with reassessment of the appropriateness of the initial regulatory action and

133. Government of Bali, UNFCCC, Conference of Parties Decision-CP.13, Bali Action Plan, *available at* http://unfccc.int/files/meetings/cop_13/application/pdf/cp_bali_action.pdf.

134. *See* Judith Jones, *Regulatory Design for Scientific Uncertainty: Acknowledging the Diversity of Approaches in Environmental Regulation and Public Administration*, 19 J. Envtl. L. 347 (2007).

135. Republic of Zambia, *supra* note 91, at 18.

136. Ministry of Environment and Agriculture, National Meteorology and Geophysics Institute, Republic of Cape Verde, National Adaptation Programme of Action on Climate Change 17 (Dec. 2007), *available at* http://unfccc.int/resource/docs/napa/cpv01.pdf.

137. Jones, *supra* note 134.

adjustment or amendment as required in light of new information, and presumably the resolution of previously identified uncertainties.[138]

Second, EIAs in developing countries have often failed comprehensively to address health concerns. This situation has been due to the lack of sound enabling legislation; the challenges of sectoral and institutional coordination between the health, environment, and other sectors; the lack of health expertise to undertake EIAs; and conceptual limitations of the extent of health issues to be covered in such assessments.[139] In Mauritius, the Environment Appeal Tribunal noted that the Ministry of Health is responsible for monitoring the conditions of permits granted after an EIA, but the grant of such a permit is the sole responsibility of the Ministry of the Environment and Quality of Life.[140]

Third, the evolution of the various impact assessments such as EIAs, Strategic Environmental Assessments, Health Impact assessments, and particularly climate change impact assessments present other challenges to developing countries. There is a complex interaction of issues relating to climate change and health. For example, health impact assessments deal with specific project or development, whereas climate change assessments operate at the macro-social level because the health impacts of climate change affect the entire population.

Fourth, climate impact assessments have been developed primarily to assess biophysical impacts for economic (agriculture, forestry) or intrinsic value (biodiversity), and have not been effectively used to assess impacts of climate change on health. Fifth, health impacts have not been well addressed in the climate change impact assessments, which lack health specific approaches.[141]

Finally, developing countries lack the required expertise to undertake these assessments.

Despite the challenges, health experts believe that climate change health impact assessments at the domestic level, led by the health or environment ministry, involving formal and health relevant assessment methods that expressly address climate change and human health, provide an effective regulatory tool.[142] Indeed, a number of developing countries have already undertaken these assessments.[143] The limitation of these initiatives is that they often lack a coherent legal framework for action, which undermines their effectiveness.[144]

138. *Id.*

139. Onzivu, *supra* note 86, at 648.

140. Ste Wiehe Montocchio v. Minister of the Env't & Quality of Life, Cause No. 2/95, *available at* http://www.unescap.org/drpad/vc/document/compendium/ma1.htm.

141. J. Patz et al., *Health Impact Assessment of Global Climate Change: Expanding on Comparative Risk Assessment Approaches for Policy Making*, 29 ANN. REV. OF PUB. HEALTH 27-39 (2008).

142. R.S. Kovats et al., *National Assessments Of Health Impacts Of Climate Change: A Review*, *in* CLIMATE CHANGE AND HUMAN HEALTH, RISKS AND RESPONSES (World Health Organization ed. 2003).

143. *Id.* at 186 (reporting that developing countries like Cameroon, Fiji, Kiribati, St Lucia, Sri Lanka, and Zambia have undertaken National Climate Health Impact Assessments).

144. *Id.*

F. Health Systems and Infrastructure: National and Local Levels

According to the WHO, a health system is comprised of "all the organizations, institutions, and resources whose primary purpose is to improve health."[145] "A health system needs staff, funds, information, supplies, transport, communications, and overall guidance and direction."[146] It needs to provide services that are responsive. Health experts have stated that the complexity of climate change is unprecedented, and that tackling the health impacts of climate change requires a public health approach based on strengthening essential public health services that extends to both clinical and population health services.[147] In many developing countries, the health systems infrastructure plays a key role in environmental health protection. Ministries of health are responsible for coordinating the health systems and infrastructure, from planning to regulation at both the national and local levels.

Therefore, health ministries are usually well-placed to provide technical and legal leadership in tackling the public health impacts of climate change. For example, to tackle the health impact of climate change, the Maldives' priority strategies for adaptation include "strengthen[ing] the regulatory and institutional capacity for vector control," "streamlin[ing] the planning of healthcare services," and "strengthen[ing] medical emergency responses."[148] The Maldives also aims to strengthen the capacity for healthcare delivery, to undertake research, and to disseminate information on climate change-related diseases. In Gambia, health has been identified as a key priority, and Gambia has undertaken to improve environmental sanitation and water management, and to promote clean technology within the health component of the climate change program.[149] The promotion of clean technology within a health program provides an example of the importance of innovative instruments in achieving health goals within the climate change regime.

In Sao Tome and Principe, projects to create a database about potential epidemic diseases related to climate change, and to correlate data for diseases of vector origin focusing on malaria through GIS systems in order to foresee the spatial risk of epidemic malaria, were identified as priority actions in the climate change program.[150]

Health ministries have helped to raise awareness of environmental health laws and policies as well as to establish the mechanisms and coordinate the personnel for implementing environmental health standards at the national and community levels. At the sub-national level, the implementation of a NAPA depends implicitly on the commitment of the responsible local authorities. Moreover, the development and implementation of environmental health policies requires action at the local level. Sub-national institutions provide an important link between national health systems infrastructures and local structures on environmental health issues. Indeed, climate change events such as floods, heat events, malaria, and other climate-related health threats are issues that can be coordinated at the

145. World Health Org., Q & A on Health Systems, http://www.who.int/topics/health_systems/qa/en/index.html (last visited Aug. 3, 2009).

146. *Id.*

147. Howard Frumkin & Josephine Malilay, *Climate Change: The Public Health Response*, Vol. 98 No. 3 Am. J. Pub. Health 435 (2008).

148. Ministry of Environment, Energy, and Water, *supra* note 89, at 41.

149. Government of the Gambia, Gambia National Adaptation Programme of Action on Climate Change 75-77 (2007), *available at* http://unfccc.int/resource/docs/napa/gmb01.pdf.

150. Republica Democratica Des. Tome e Principe, *supra* note 131, at 24.

local level. Moreover, local health systems have the important roles of enacting local policies, shaping national environmental health policies that take account of local circumstances, and helping to enforce national environmental health standards within a local setting.

In health ministries as well as local environmental health systems, competing priorities and a lack of funding are likely to cast health issues relating to climate change as the lowest of priorities. The challenge in developing countries is that environmental health laws and policies remain underdeveloped; the health sector is focused on infectious diseases, health care, delivery, etc.; environmental health focuses on water, sewage, sanitation, etc.; and modern issues such as climate change are not prioritized at the local or community levels.[151] The focus on curative health care that ignores environmental systems is even more pronounced in some cities in Africa.[152] Although it has improved, this state of affairs persists. Furthermore, unclear institutional responsibilities, lack of coordination and cooperation between health ministries and other national institutions as well as between the national institutions and local environmental health systems, undermines efforts to deal with the public health impacts of climate change. For example, in Kenya, a study reports that the Health Ministry often fails to implement key initiatives due to unrealistic policy targets, lack of political support resources, operational management of strategies and means to evaluate implementation of policies, and poor communication between the different levels of health systems.[153]

G. Capacity Building: Legal, Technical and Financial Assistance

Capacity building is about enhancing the domestic implementation of climate change. It also includes support for substantive technical issues for implementation, such as project management skills (e.g. project proposal writing), other technical and legal capacities such as drafting legislation, undertaking certain technical basic research, or problem-analysis and mobilization of financial resources available to the parties to implement their obligations under the UNFCCC. New environmental legislation in developing countries is of questionable value if it is not accompanied by a substantial increase in each country's capabilities for policy development, training management, monitoring, and enforcement personnel, and institutional structures and administrative competence.[154]

Despite the limitations to their adaptive capacities, some countries are making efforts to build domestic capacities to deal with climate change. In Vanuatu, capacity building for the development of adaptation measures has been elevated to mainstream adaptation measures as a practical means for protecting and building sustainable Vanuatu communities and enhancing national and community level capacity to tackle the serious health and

151. Onzivu, *supra* note 86, at 648.

152. Erik Nordberg & Uno Winblad, Urban Environmental Health and Hygiene in Sub-Saharan Africa: Current African Issues 18, 24 (Nordiska Afrikainstitutet [Nordic African Institute], ed., 1994), *available at* http://www.nordicafricainstitute.com/publications/download.html/9171063641.pdf?id=24781.

153. Anna H Glenngard & Thomas M Maina, *Reversing* the Trend of Weak Policy Implementation in the Kenyan Health Sector?–A Study of Budget Allocation and Spending of Health Resources Versus Set Priorities, Health Research Pol'y and Sys., Mar. 2007, at 1.

154. J. Mayda, *Environmental Legislation in Developing Countries: Some Parameters and Constraints*, 12 Ecology L.Q. 997, 1013, 1023 (1985).

other impacts associated with climate change.[155] In Mozambique, a project to strengthen an early warning system included the training of health officials.[156] In Gambia, the raising of public awareness and the training of disease surveillance personnel have been identified as key areas of the health program.[157] In the Maldives, the priority for capacity building for health includes training health personnel and sensitizing communities to vector control. But the lack of human resources, technical expertise, and financial resources were identified as key impediments in implementing the health projects.[158] In Sao Tome and Principe, study visits and the training of doctors, nurses, volunteers, volunteer students, etc. for emergency needs were identified as impediments.[159]

A key issue in tackling the public health impacts of climate change is the importance of strategies, mechanisms, and measures that can enhance adaptation capabilities in developing countries. The IPCC has identified features that determine capacity for adaptation: economic resources, technology, information and skills, infrastructure, institutions, equity, and the existing burden of disease.[160]. According to the World Bank, health spending in Africa continues to plummet with a public health expenditure of $4 per capita.[161] Hence, adaptation is constrained by the lack of resources.[162] The limited availability of technology, such as diagnostic equipment, warning systems, air conditioning, pollution controls, vector control technology, vaccinations, water treatment technology, etc. affects the capacities of developing countries to tackle the health impact of climate change.

Unfortunately, developing countries lack technologies to deal with climate related events that trigger health problems. For example, public health infrastructures such as sanitary and waste treatment facilities that would reduce vulnerability to climate change are often inadequate, especially in rural areas.

Developing countries suffer from a double burden of disease; infectious diseases such as malaria, TB, and HIV-AIDS, and non-communicable diseases such as cardiovascular diseases are both issues of concern. In these situations, health resources and infrastructures are strained, and the health impacts of climate change are tackled using ad hoc rather than through systematic and formal regulatory mechanisms. In Uganda, implementation of the NAPA requires financial resources from the Government of Uganda, Bilaterals, Multilaterals, NGOs, and CBOs.[163] Financial requirements include the costs of training communities, construction works, technology development, and the facilitation of project component personnel.[164] In Zambia, the lack of financial resources, due to poverty and HIV, available to implement adaptation measures for climate change was identified as a

155. REPUBLIC OF VANATU, *supra* note 123, at 19-20.

156. MINISTRY FOR THE COORDINATION OF ENVIRONMENTAL AFFAIRS, *supra* note 105, at 2-3.

157. GOVERNMENT OF THE GAMBIA, *supra* note 149, at 58.

158. MINISTRY OF ENVIRONMENT, ENERGY, AND WATER, *supra* note 89, at 63-64.

159. REPUBLICA DEMOCRATICA DES. TOME E PRINCIPE, *supra* note 131, at 34.

160. CLIMATE CHANGE 2001, *supra* note 2.

161. WORLD HEALTH REPORT, *supra* note 29, at 137; *see also*, DAVID H. PETERS ET AL., HEALTH EXPENDITURES, SERVICES AND OUTCOMES IN AFRICA, BASIC DATA AND CROSS NATIONAL COMPARISONS, 1990-1996 39 (Human Development Network, The World Bank 1999).

162. *See* World Bank, *Health Expenditures, Services, and Outcomes in Africa*, No. 157, April 2000, *available at* http://www.worldbank.org/afr/findings/english/find157.htm.

163. GOVERNMENT OF UGANDA, *supra* note 108, at 49-50.

164. *Id.*

limitation.[165] Samoa's NAPA identifies the lack of human capacity as well as low levels of community capacity to deal with the health impacts of climate change as major challenges to implementation of the health priorities in the Plan.[166]

The initial work on adaptation financed by the Global Environment Facility (GEF) consisted of studies and assessments of climate change impacts, as well as enabling activities for countries to prepare their NAPAs in the case of Least Developed Countries.[167] But the GEF mandate under the UNFCCC has evolved significantly in recent years, focusing now on financing concrete adaptation actions. The GEF strategy on adaptation has also evolved in this direction.[168]

The GEF currently has three avenues for funding adaptation-related projects: the Strategic Priority on Adaptation (SPA) under the GEF Trust Fund, the Least Developed Countries Fund (LDCF), and the Special Climate Change Fund (SCCF).[169] Individual countries determine their own adaptation priorities via their NAPAs.[170] So far, the priority areas for action by the LDCF as they relate to the experience of specific national NAPAs are: water resources, food security and agriculture, health, disaster preparedness and risk management, coastal zone management and infrastructure, natural resource management, and community-based adaptation.[171]

According to the GEF, some sectors have been covered more extensively than others. For example, almost all projects list water resources and disaster risk management as the most important components, followed by natural resources/biodiversity, agriculture, and coastal zone management.[172] The GEF acknowledges that the sectors with fewer GEF projects thus far are public health and disease monitoring, land management, and infrastructure development.[173]

In conclusion, the restoration and improvement of general public health infrastructures will enable developing countries to tackle the public health effects of climate change and capacity building. Legal, technical, financial, and other resource assistance plays a pivotal role in these efforts.[174]

H. Climate Change and Health Civil Society and Communities

Article 7, paragraph 6, of the UNFCCC provides for the admission of non-governmental organizations to sessions of the UNFCCC bodies as observers.[175] Civil society has continued to play a key role in efforts to tackle climate change, even in developing coun-

165. Republic of Zambia, *supra* note 91, at 17.

166. Ministry of Natural Resources, Environment & Meteorology, *supra* note 113, at 35.

167. Global Environment Facility, Elements for an M&E Framework for Climate Change Adaption Projects, Lessons from GEF Climate Change Adaptation Projects 2 (2008), *available at* http://www.esdevaluation.org/images/GEF_EO_M_E_Framework_Adaptation.pdf.

168. *Chacón v. Ministry of Health and Mun. of Santa Anna*, 4 I Envtl. L.R. 177, 177-78 (2004).

169. Global Environmental Facility, *supra* note 167, at 1.

170. *Id.*

171. *Id.* at 3.

172. FCCC, *supra* note 41, art. 7.

173. Global Environment Facility, *supra* note 167, at 2.

174. *Id.* at 3.

175. *Id.* at 2.

tries.[176] Members of civil society involved in climate change movement include the scientific community, non-profit environmental groups and associations, private companies and business concerns, legal organizations, the academic community, and individuals. Public health scholars have emphasized the importance of coordination between government agencies at both national and local levels, as well as the involvement of academia, the private sector, and nongovernmental organizations.[177]

For example, community involvement in environmental health management and a shift away from an exclusively "top-down" approach to one of dialogue, negotiation, and partnership to resolve environmental sanitation and vector control problems in developing countries has been noted to be a successful approach to resolving a public health issue.[178] Through litigation, NGOs and individuals have been able to compel public authorities to enforce environmental laws to protect health.[179] In *Chacon v. Ministry of Health*,[180] the plaintiff, a minor, petitioned the court to compel the Costa Rican Ministry of Health to protect his constitutional rights to a healthy environment, infringed upon by waste disposal permitted by municipality authorities.[181] The Costa Rican Supreme Court of Justice held that a pollutant negatively affects or damages life, health, or the well-being of humans, flora, fauna, and that general environmental quality and laws alone cannot guarantee environmental protection and will require individuals and populations as well.[182] The Ministry of Health and the municipality were ordered to ensure the closure of the waste disposal site and any disposal therein.[183] The case highlights the importance of citizen participation in environmental health governance in a developing country.

In fact, a number of NGOs in developing countries have become involved in efforts to tackle the health impact of climate change. There are challenges facing NGO participation in environmental health management and climate change policy making in developing countries. First, the multitude of constitutional and other legislative enactments in African and Asian countries for public participation in environmental decision-making tend to be rhetorical, and have often been ignored by policy-makers.[184] Second, few members of the Climate Action Network, the major network of NGOs working for climate change in developing countries, emanate from the health sector but are part of the mainstream environmental or green groups. Moreover, many of the traditional health

176. *See, e.g.*, Climate Action Network, http://www.climatenetwork.org/about-can/index_html (last visited Aug. 5, 2009) (a network of over 350 NGOs dedicated to tackling climate change).

177. Frumkin, *supra* note 147, at 435.

178. Michael B. Nathan et al., *Community Participation in Environmental Management for Dengue Vector Control: Experiences from the English-speaking Caribbean*, 28 DENGUE BULLETIN (SUPPL.) 13, 13-16, *available at* http://www.searo.who.int/LinkFiles/Dengue_case_study_2__caribbean_.pdf.

179. *See* Envtl. Action Network, Ltd. v. Attorney Gen. & Envtl. Mgmt Auth., Misc. Application No. 39 0f 2001(H.C) (Uganda), *available at* http://www.greenwatch.or.ug/pdf/judgements/TEAN%20Versus%20A.G%20&%20NEMA.pdf; Rural Litig. & Entitlement Kendra v.Uttar Pradesh, A.I.R. 1985 S.C. 652 (India), *available at* http://www.unep.org/padelia/publications/Jud.Dec.Nat.pre.pdf.

180. Chacón, *supra* note 168, at 179.

181. GOVERNMENT OF UGANDA, *supra* note 108, at 49-50.

182. Chacón, *supra* note 168, at 179.

183. *Id.* at 180.

184. *See* BENJAMIN J. RICHARDSON & JONA RAZZAQUE, PUBLIC PARTICIPATION IN ENVIRONMENTAL DECISION-MAKING, ENVIRONMENTAL LAW FOR SUSTAINABILITY 178 (Benjamin J. Richardson & Stephan Wood, eds., Hart Publishing 2006).

NGOs have not embraced broader environmental concerns in order to promote public health.[185]

Climate change requires a high scientific base, yet there is low-level networking, technical and scientific knowledge exchanged among various local and national NGOs, which requires a high level of capacity building. A number of industry organizations are members of the Climate Action Network, and potentially can play a role in counteracting the health impacts of climate change. But the disregard of environmental and health legislation by local industries in developing countries has been a source of concern.[186]

V. Conclusions for Strengthening Policy

While climate change is a global problem that requires global action, domestic governance mechanisms play a critical role in translating any global measures adopted to counteract the health impact of climate change at the domestic level. These global measures require effective responses from the health sector, and environmental health governance offers an important avenue in this regard. But scholars have concluded that post-colonial governance structures in developing countries reflect the status quo: that in their preoccupation with economic exploitation of the colonies, colonial powers have created few institutional structures for good governance.[187] While some relevant legal reforms have taken place, the challenge is to translate domestic environmental governance into effective tools for tackling climate change, especially its potential health effects.

A number of immediate governance-related actions would be required. These actions include completion of the Health, Vulnerability, and Adaptation assessments across countries, and enhanced coordination between Health, Environment, and Finance Development Ministries, including appropriate health representation on the relevant climate change committees. These actions may require creating specific memoranda of understanding between health and relevant ministries. It will also require improved recognition and funding of preventative health measures, both from traditional overseas development assistance and from climate change funds. Reforming environmental and health laws to address these challenges may also be required, as well as the provision of legal frameworks for NGO and community consultations.

But strengthening governance is just one aspect of tackling the health impact of climate change in developing countries. Climate change equity requires developed nations to provide substantial technical and financial support to tackle climate related health impacts in developing countries. This support requires these countries to take their climate change obligations seriously, and to prioritize health in the ongoing development of international climate change law and policy.

185. *See* Onzivu, *supra* note 86, at 675.

186. *See* Kamau Evanson Chege, *Environmental Law and Self-Management by Industries in Kenya*, 17 ENVTL. L.J. 229 (2005).

187. *See* Richardson, *supra* note 90, at 416.